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HIGH THROUGHPUT PHENOTYPING METHODS FOR SCREENING RICE GERMPLASM UNDER WATER LIMITED FIELD CONDITIONS

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A Cirad project (Orytage) involving NARS and IRC aims at developing an international phenotyping network for rice adaptations to drought and thermal stresses in the context of gene discovery and genetic mapping. Relevant association mapping depend on improved methods for high quality and high throughput phenotyping in the field. In case of drought the Infrared thermography was used to phenotype the plant transpiration capacity in relation with carbon isotopic discrimination, soil moisture and atmosphere demand.

Two hundreds varieties representative of the Oryza sativa japonica group were phenotyped under drought condition at the Villavicencio CIAT experimental station (Colombia) during the dry season 2009/2010. Irrigation was suspended for two weeks at vegetative stage (45-60 DAS). Drought response was evaluated based on canopy temperature with an infra-red thermographic camera. The methodology was improved by CWSI (crop water stress index) calculated to normalize canopy temperatures against micro-meteorological weather fluctuations, and complemented with delta 13C measurements indicative of water use efficiency (WUE). Leaf temperature at vegetative stage exhibited strong and significant varietal differences that were negatively correlated with soil moisture content. This phenotyping approach permitted identifying genotypes with good maintenance of transpiration capacity (and thus sustained growth) under drought stress, related mainly to limited water extraction and/or greater root depth.

The integration of high throughput phenotyping with genetic association study on a japonica rice variety panel, present a significant advance in order to identify genomic regions of interest and polymorphisms for marker development (ongoing). This will eventually permit developing efficient marker-assisted selection (MAS) approaches.